



Relationships Between Discharge And Water Quality In Florida Springs

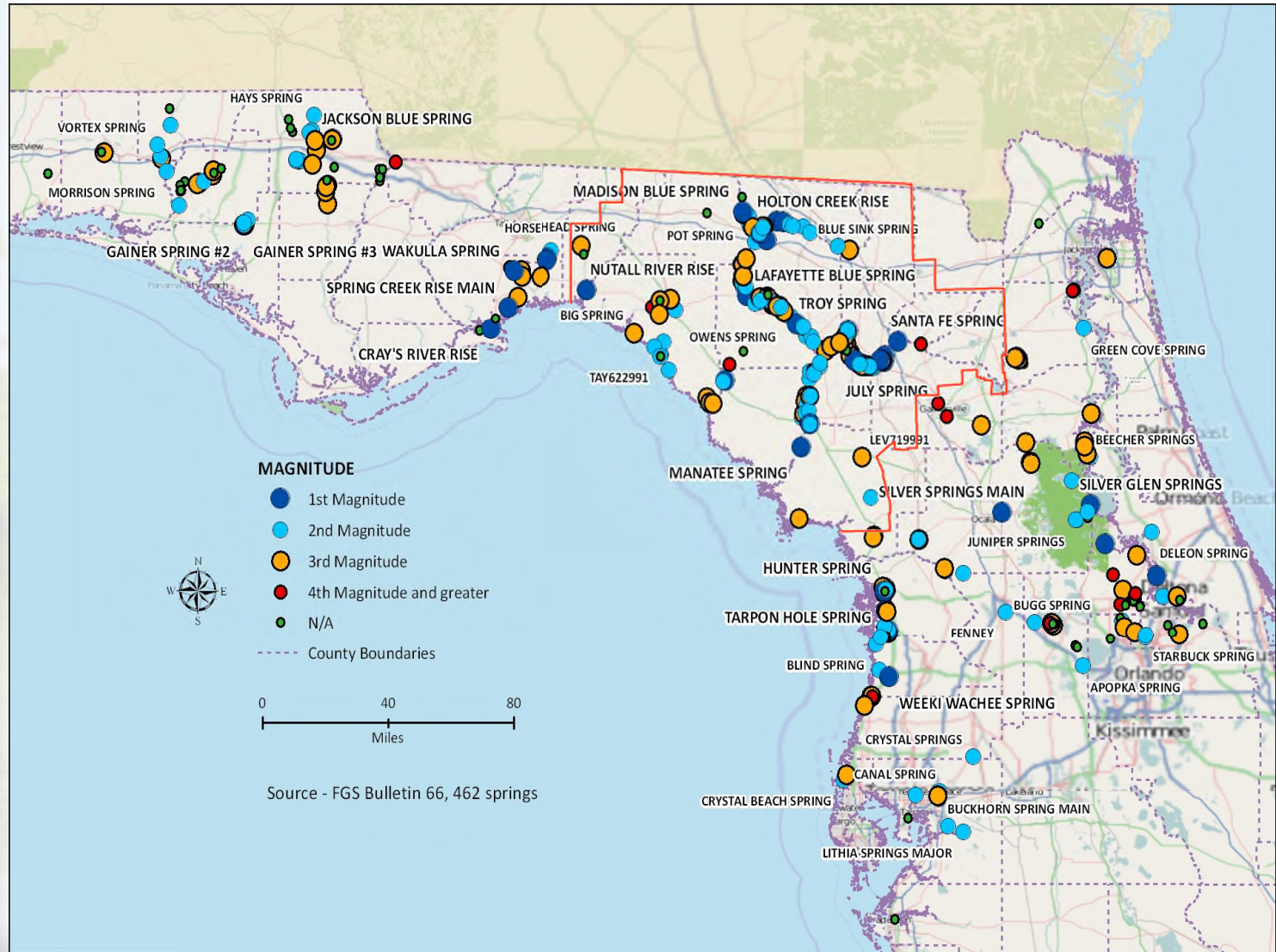
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Suwannee River Water Management District



Springs Heartland



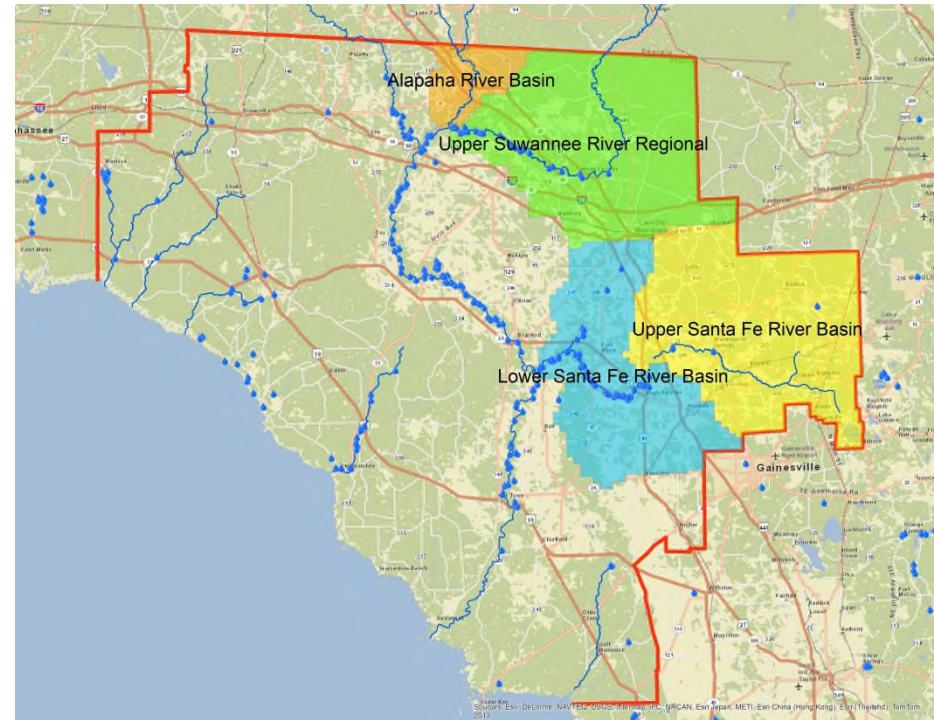
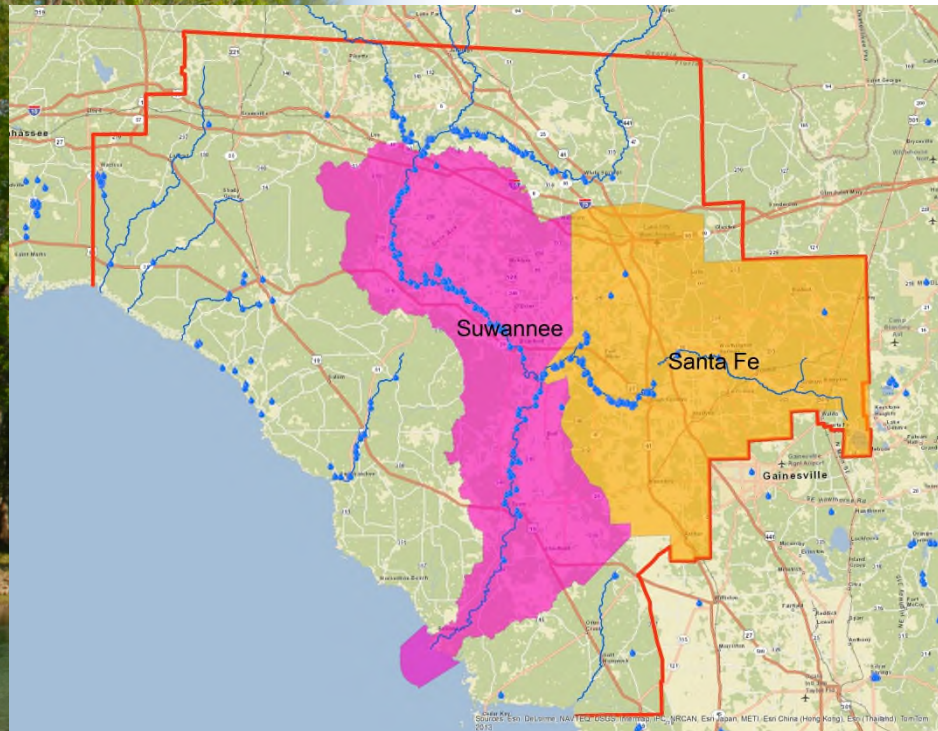


Threats to Springs Health

| Threat | Florida's Management Approach |
|---|---|
| Water Quality – Nitrate Eutrophication | Total Maximum Daily Load (TMDL) and Basin Management Action Plan (BMAP) |
| Water Quantity – Flow, Level and Velocity | Minimum Flows and Levels (MFLs) |
| Biological Community (Invasives & Migratory Restrictions) | Site-Specific Management |
| Disturbance (Erosion, Prop Scars, Trampling) | Site-Specific Management |

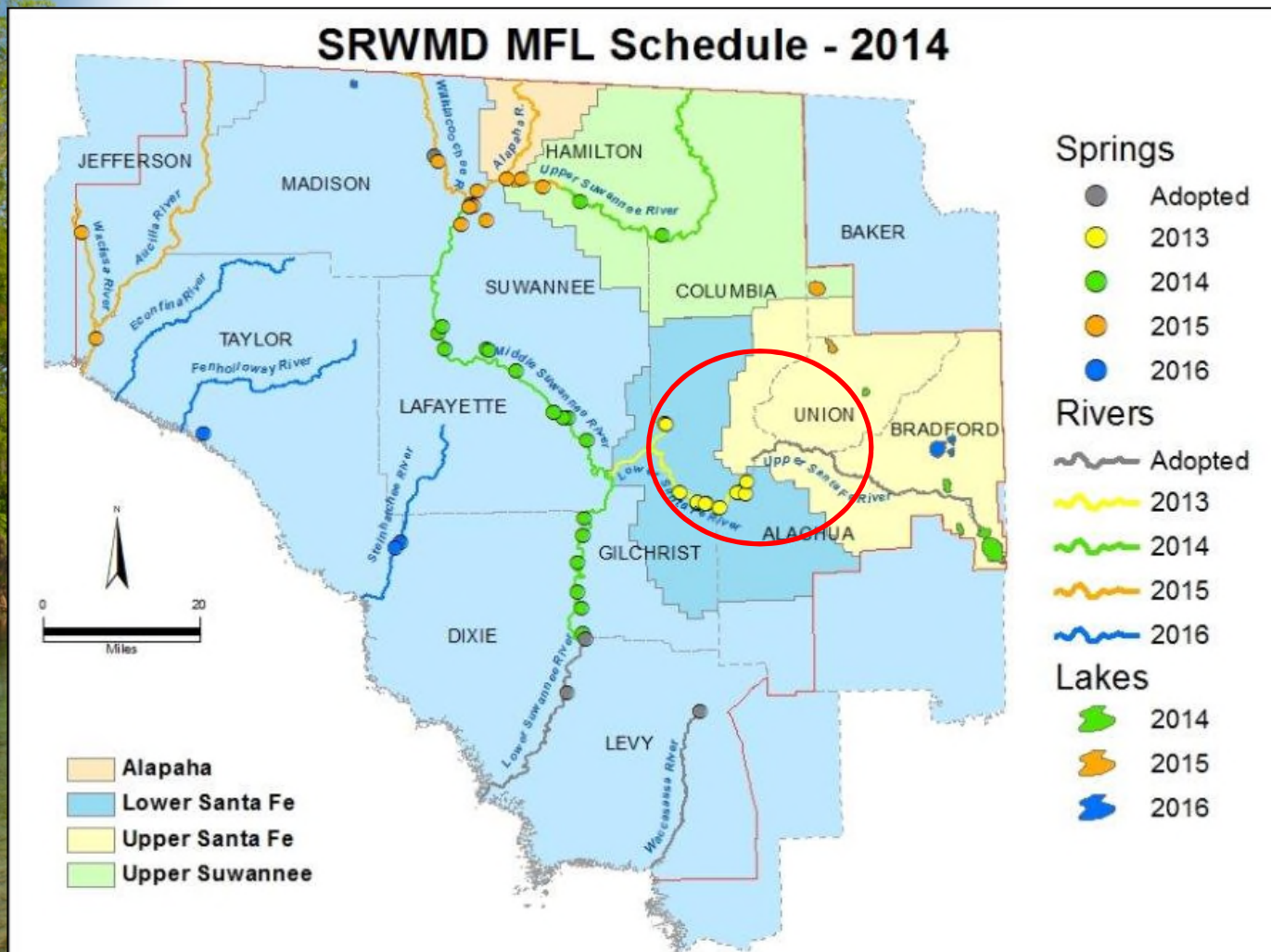


Nutrient BMAPS and Water Use Caution Areas





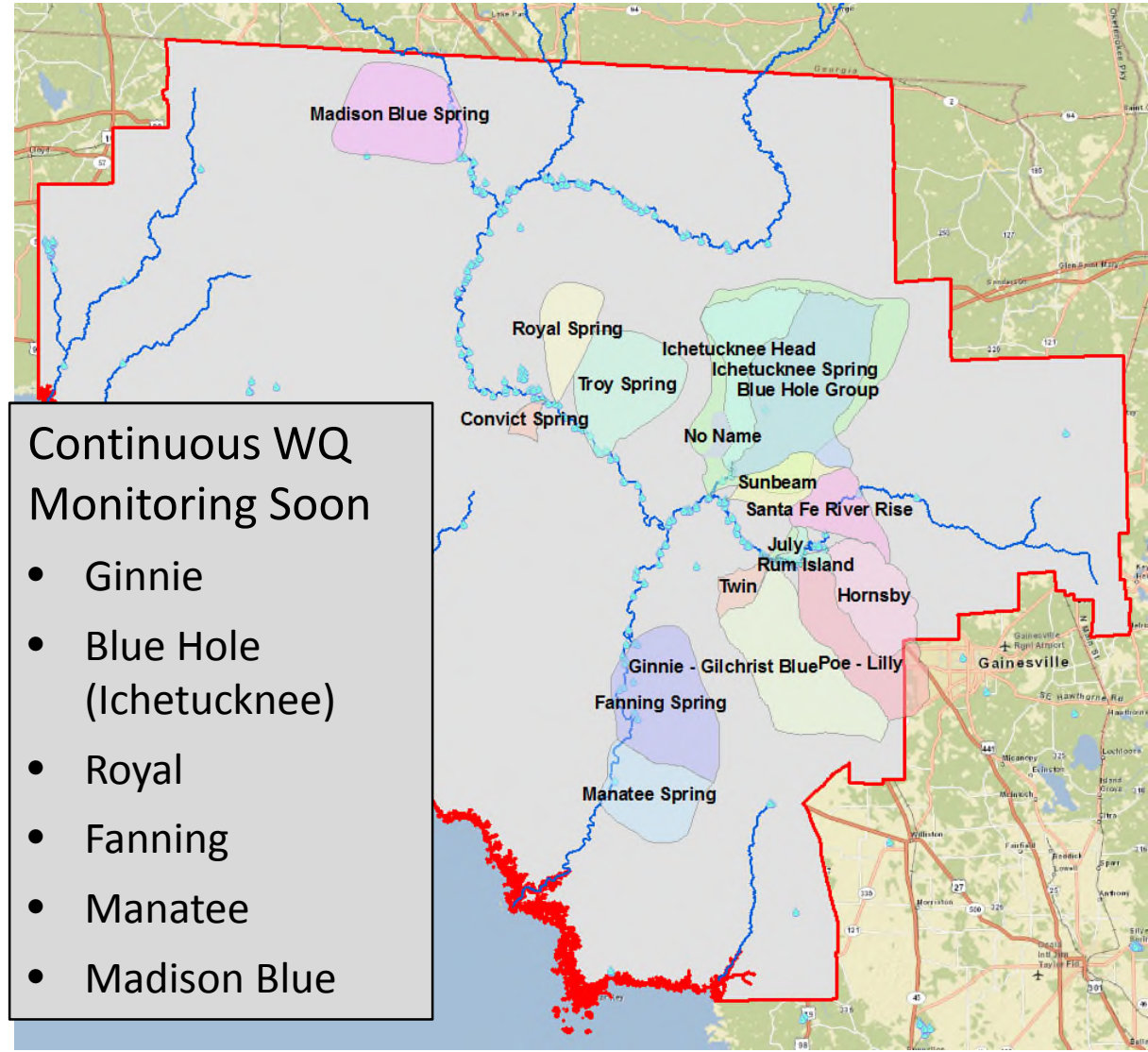
Minimum Flows and Levels





Delineated Springsheds

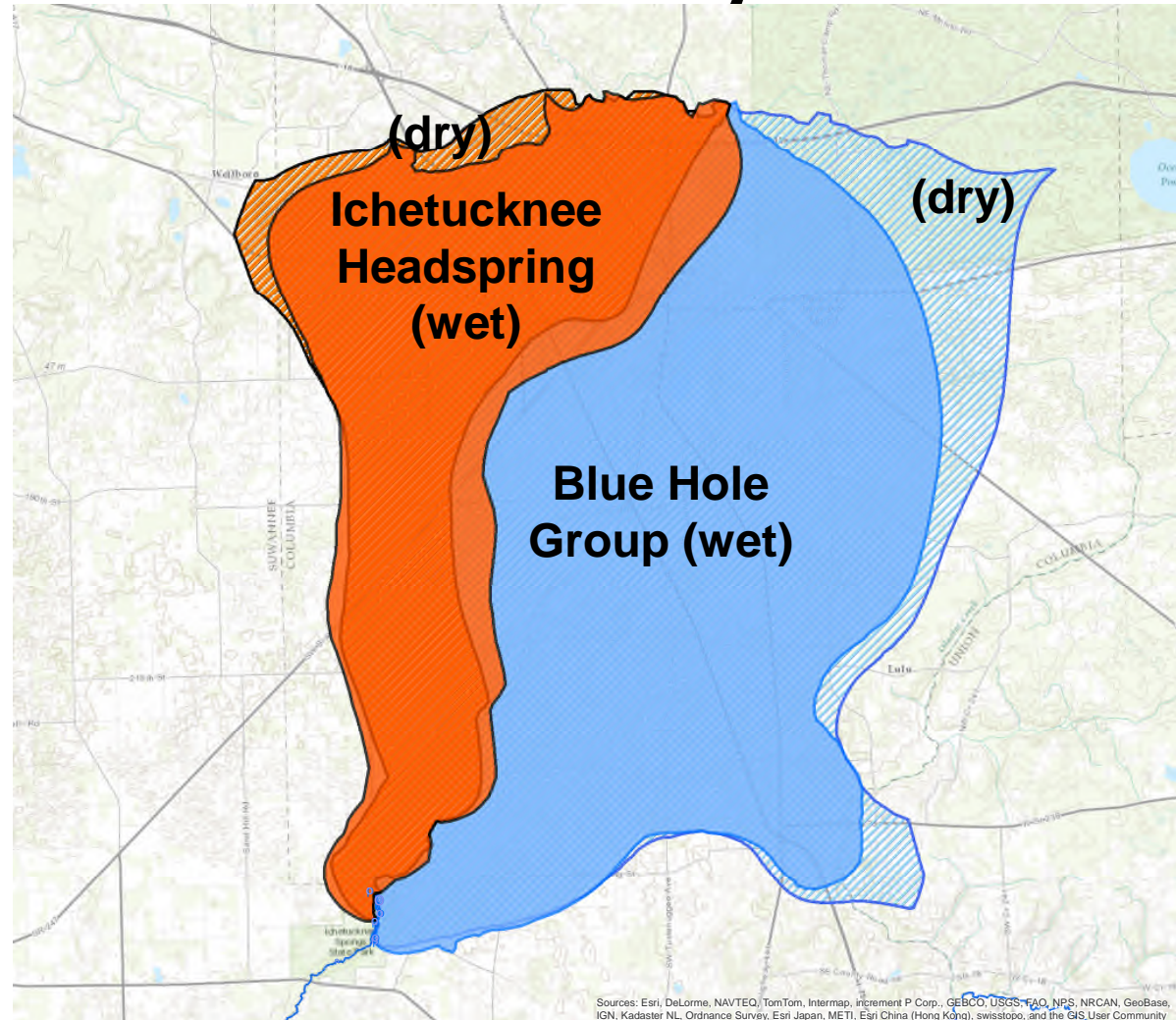
- Small fraction of identified springs have been delineated
- Creates challenges for cost-effective hydrologic or water quality restoration efforts



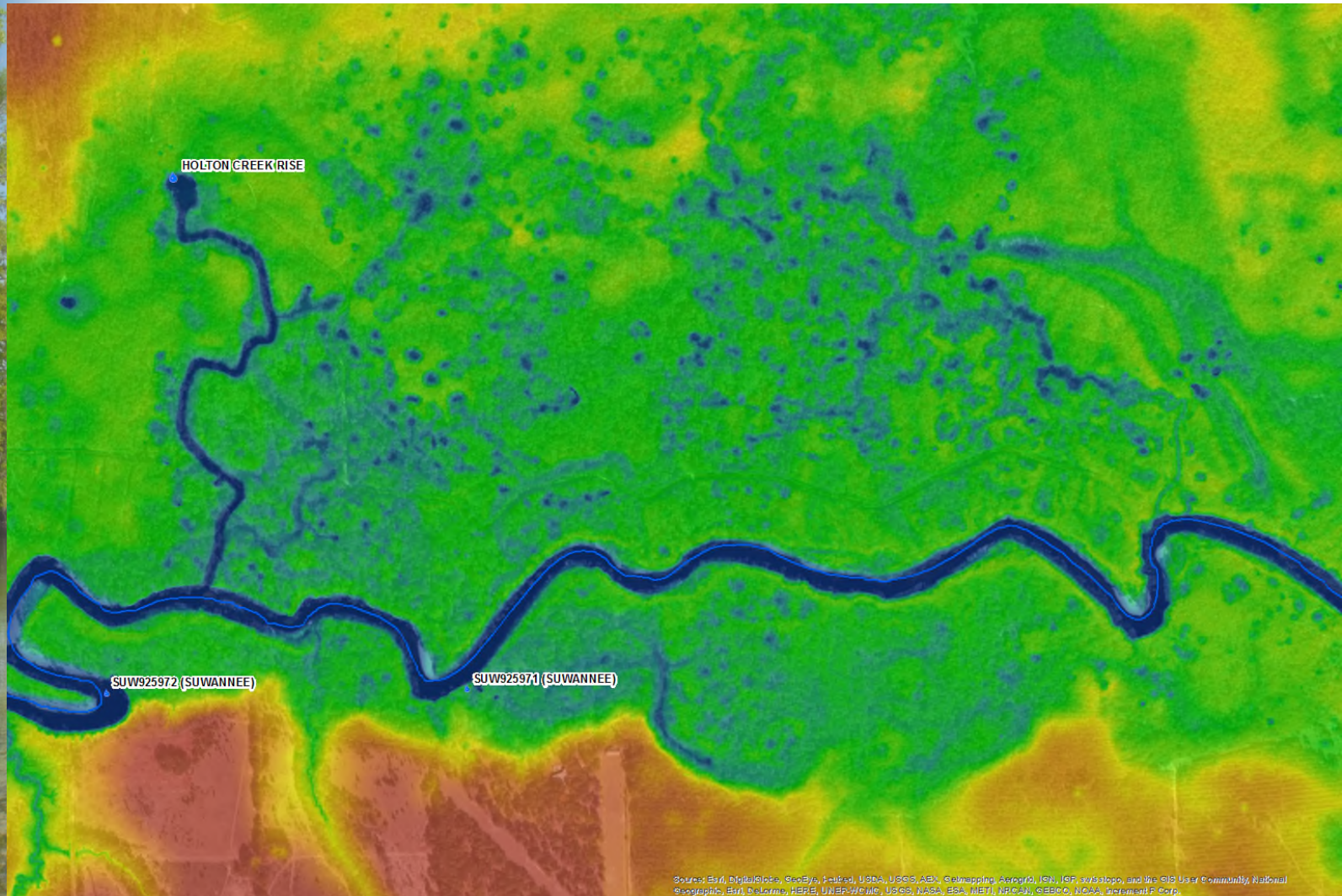
Continuous WQ Monitoring Soon

- Ginie
- Blue Hole (Ichetucknee)
- Royal
- Fanning
- Manatee
- Madison Blue

Ichetucknee Springshed Variation Wet Vs. Dry



A tall, slender tree with a light-colored trunk stands on a rocky shore, its reflection visible in the clear water. The tree has a thick, light-colored trunk that splits slightly into two main stems near the base. The foliage is dense and green, with some branches extending over the water. The water is very clear, showing the rocky bottom and the reflection of the tree. The background is a dense forest of similar trees, and the sky is a clear, bright blue.



Sources: Esri, DigitalGlobe, GeoEye, Earthstar (United States), USGS, AeroGRID, IGN, ISF, swissinfo, and the GIS User Community, National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment F Corp.

Loss of SAV Is an Expression of Poor Springs Health

Ichetucknee Springs 1995

Ichetucknee Springs 2012

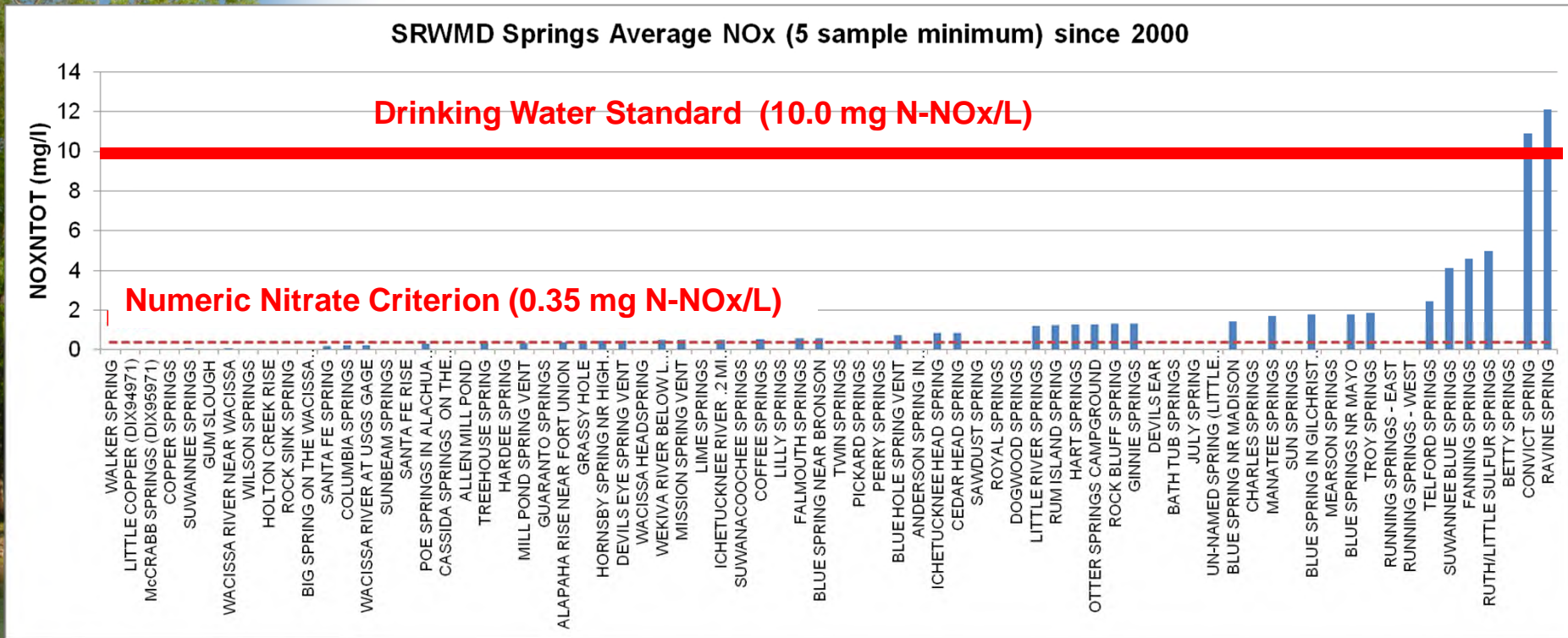


Courtesy: John Moran Photography

Suwannee River Water Management District



SRWMD Springs and FDEP's Nitrate Criterion

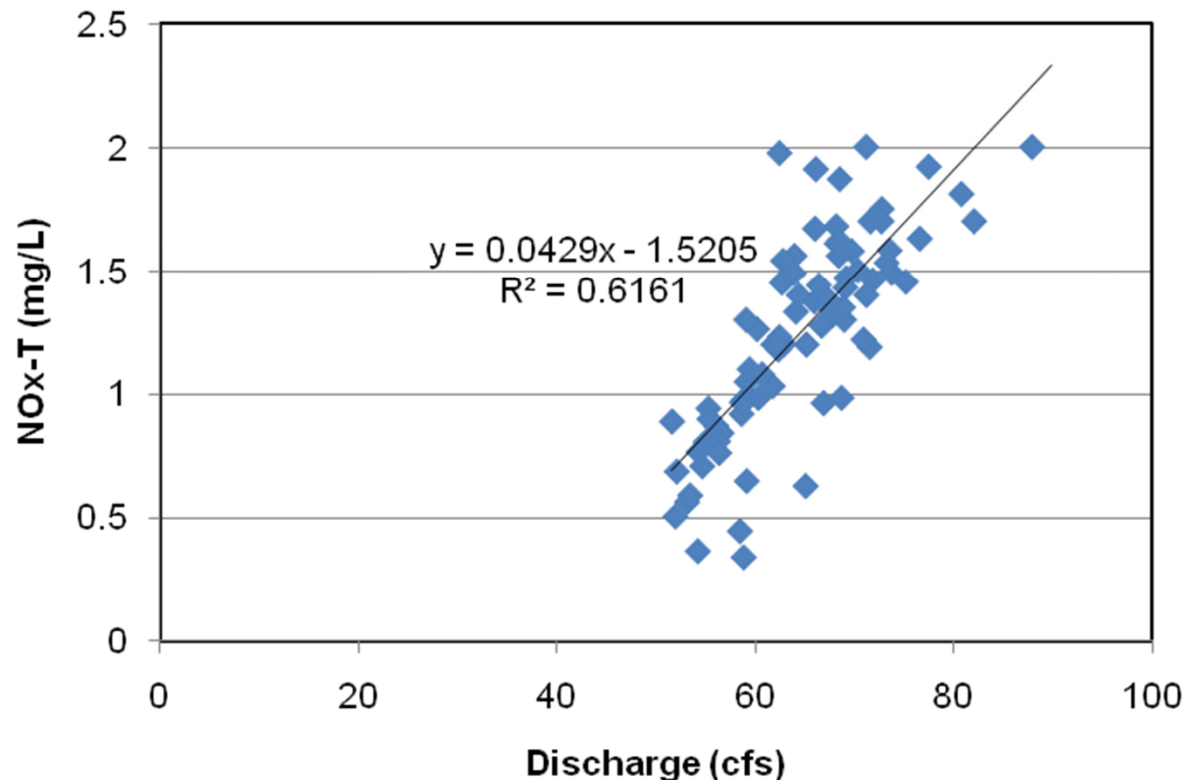


Source: SRWMD data, all springs listed have at least one nitrate value, however only those with 5 or more samples since 2000 show a bar.



Nitrate – Flow Relationship

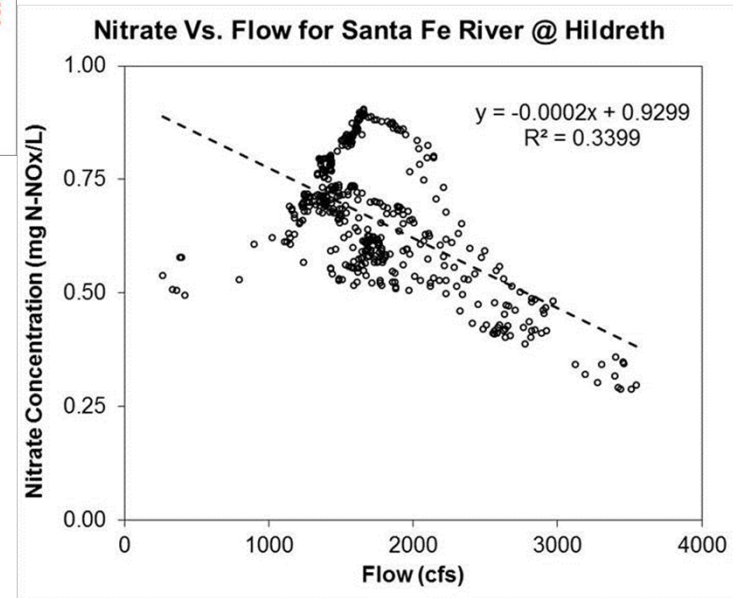
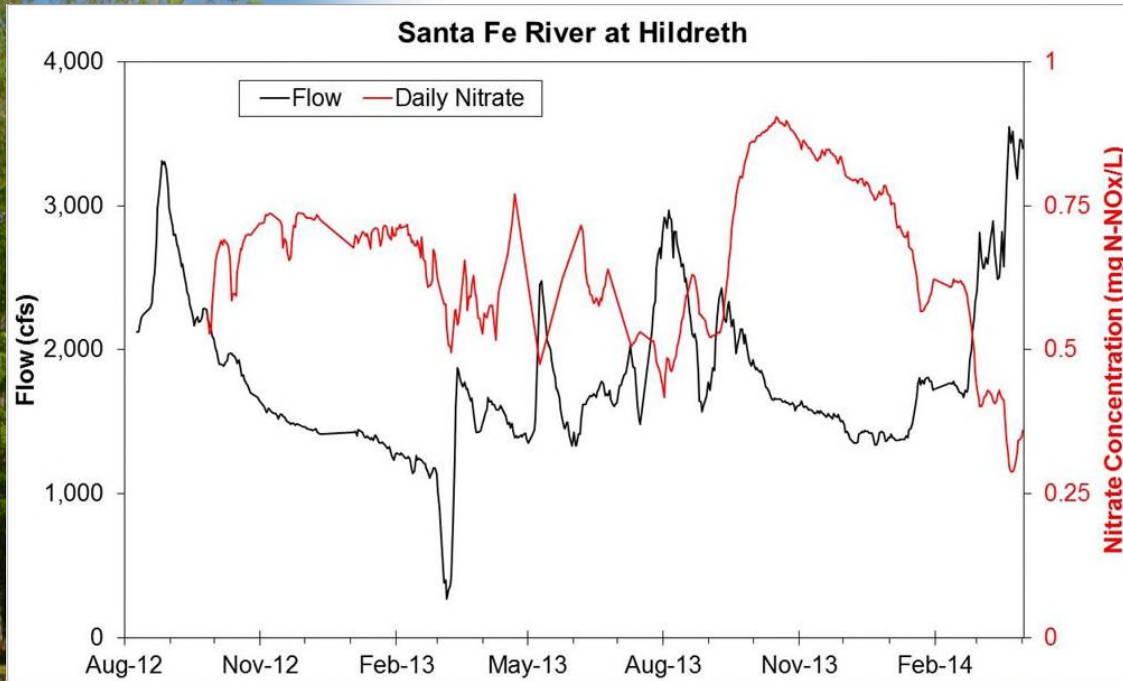
**Wekiwa Springs Discharge Vs.
NOx-T. Relationship Significant
($p \sim 0$)**



Strong positive correlation supports a view that spring flows are a mix of older less enriched water and younger, shallower water. Identifying these shallow locations is important.

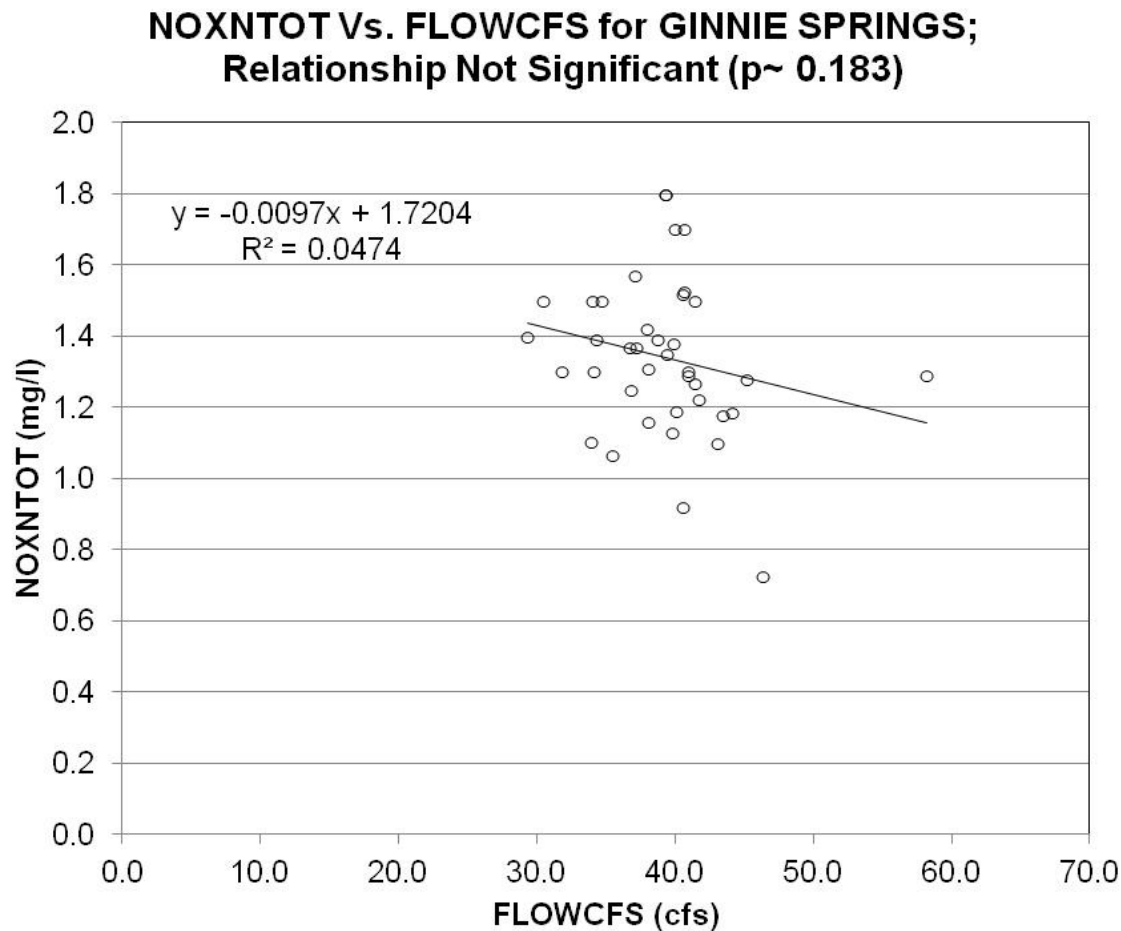


Springfed River System





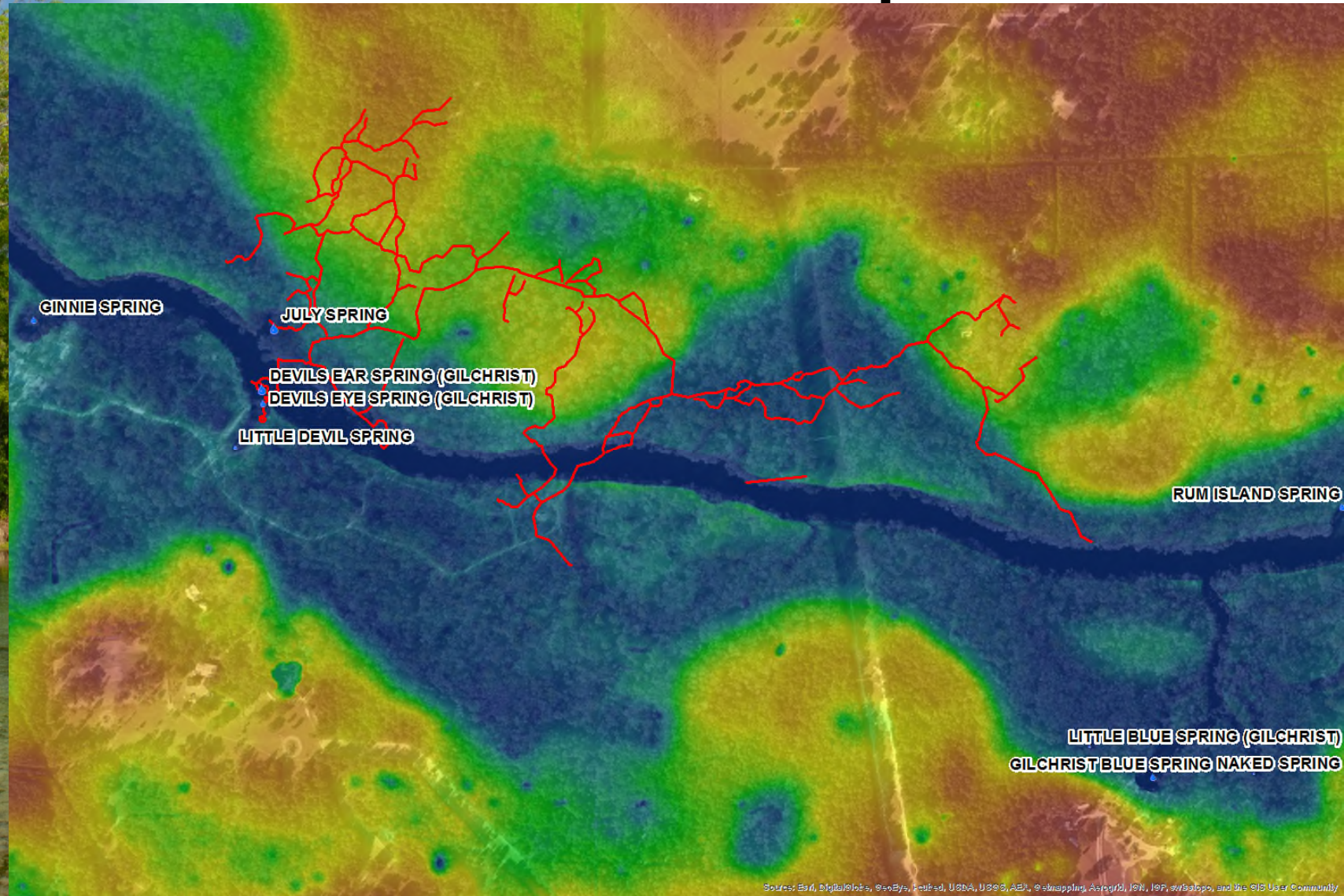
Nitrate – Flow Relationship



No hint of correlation, let alone positive correlation.



Ginnie Cave Map





Nitrate Results

| | | Nitrate Trend Over Time | | |
|-------------------------------|----------|---|---|--|
| | | Positive | None | Negative |
| Nitrate Correlation with Flow | Positive | Ruth / Little Sulfur, Convict, Madison Blue, Silver, Weeki Wachee | Suwannee Blue, Santa Fe, Troy, Telford, Columbia, Falmouth, Palm, Sanlando, Miami | Hornsby, Poe, Little River, Rock, Wekiwa |
| | None | Manatee, Fanning, Gilchrist Blue, Ginnie, Hart, Rock Bluff, Chassahowitzka, Homosassa, Pump House & Trotter, Silver, Gum Springs, Rainbow | Otter, Rum Island, Wacissa, Alaphaha Rise (weak), Apopka, Starbuck | Treehouse |
| | Negative | | Blue Hole (weak) | |

Exurgence Vs. Resurgence

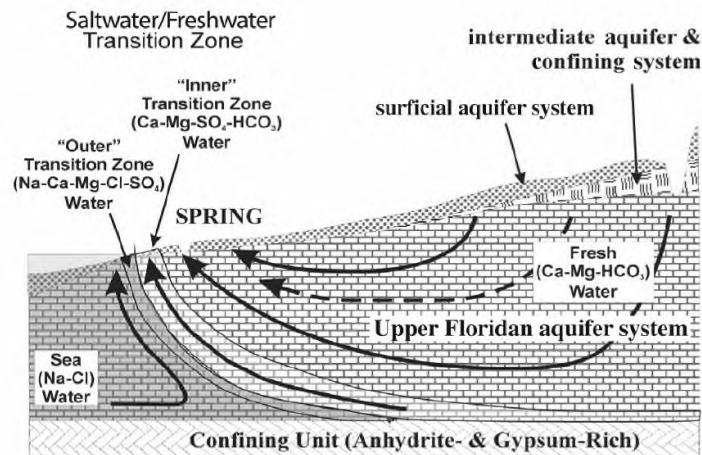
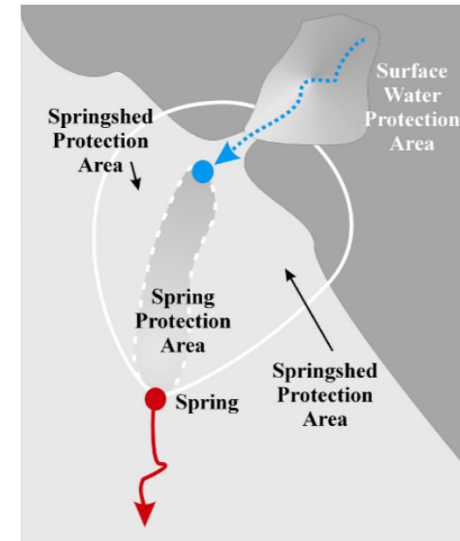
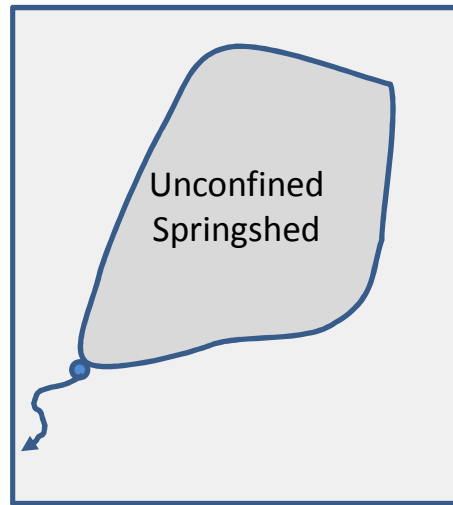
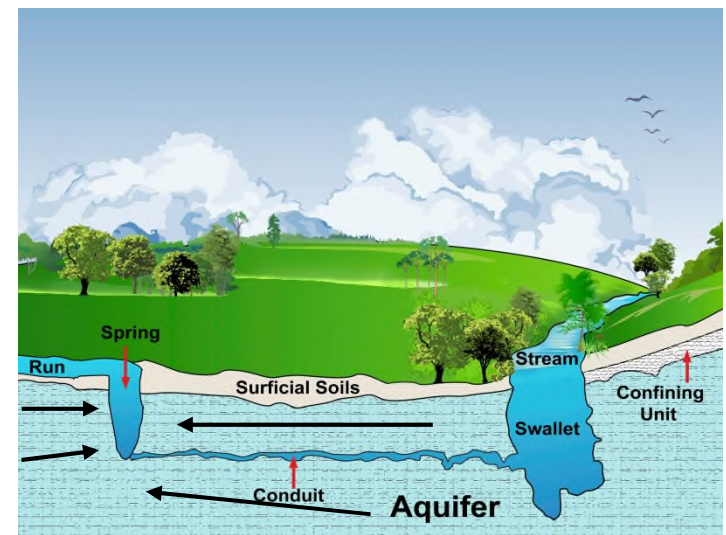
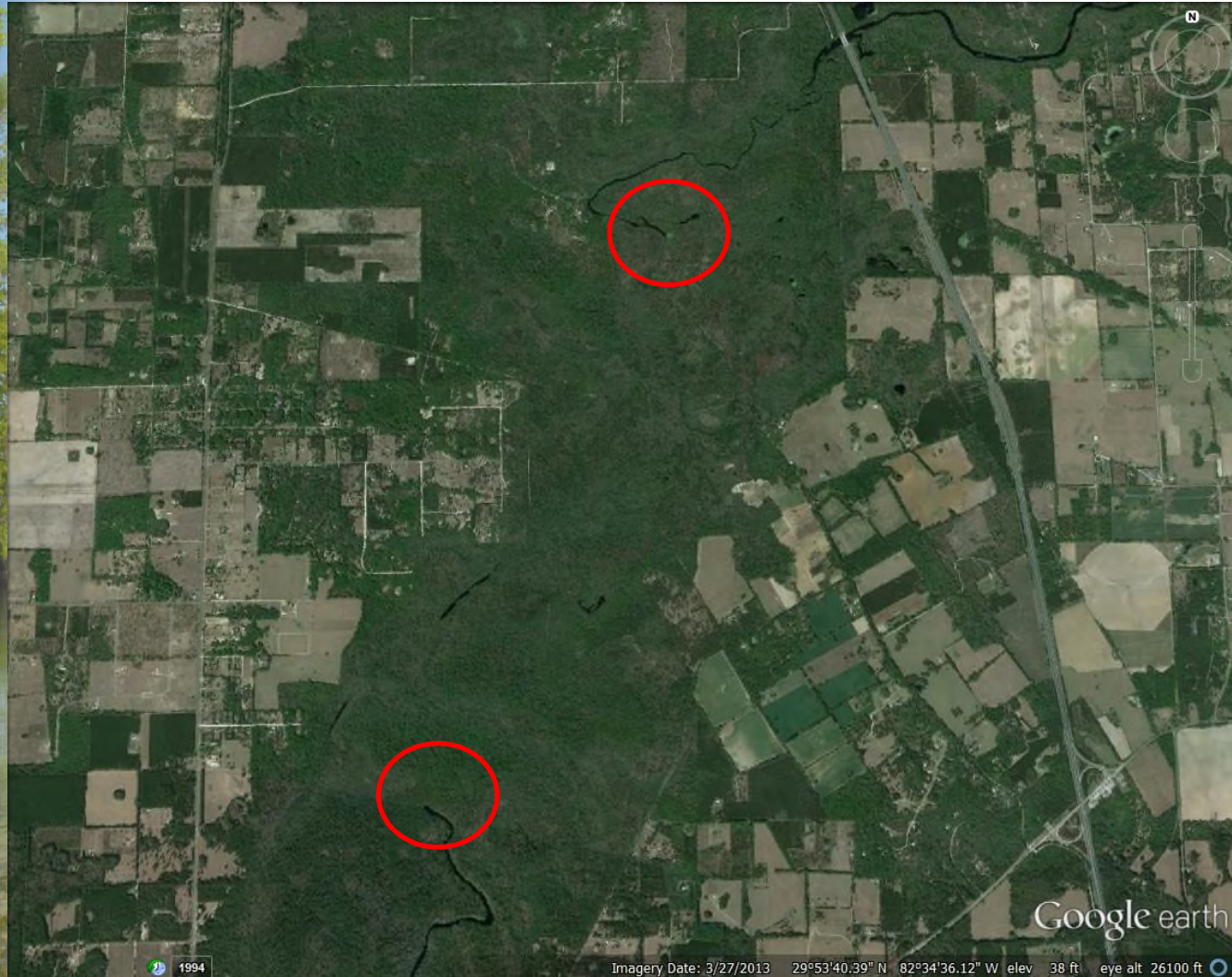


Figure 55. Relative position of rock-matrix and saline analytes in the Upper Floridan aquifer system.



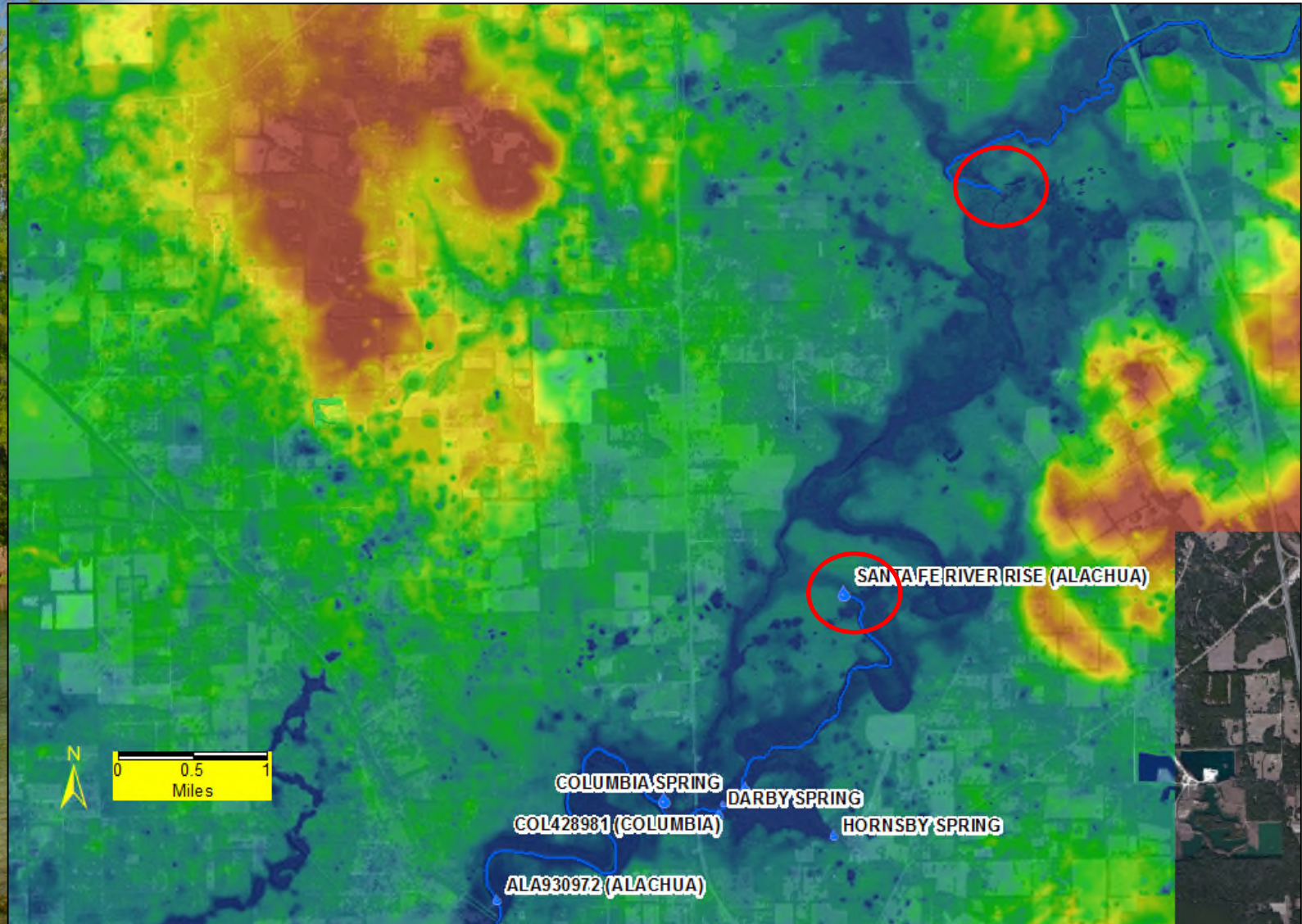


Santa Fe River

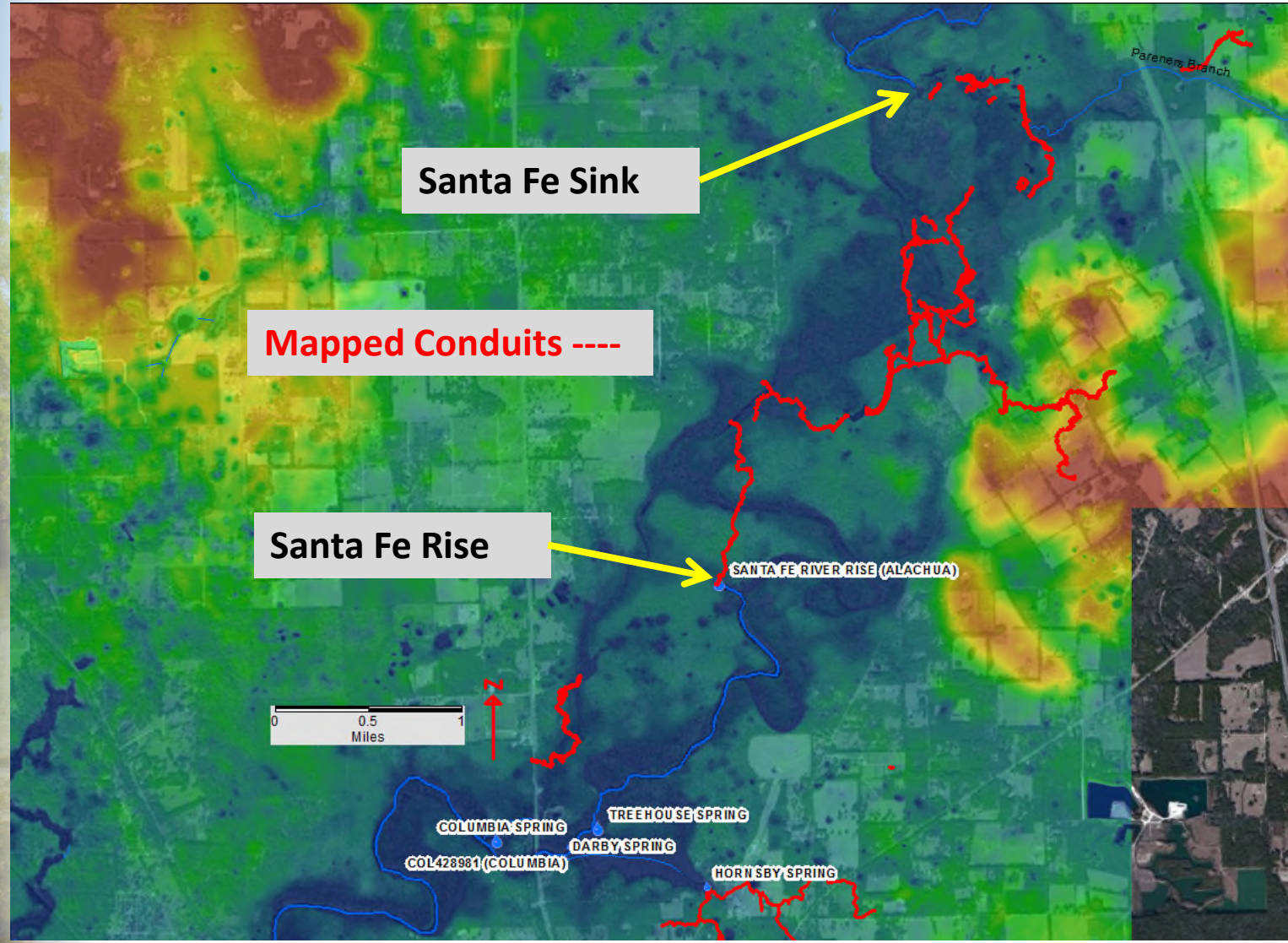




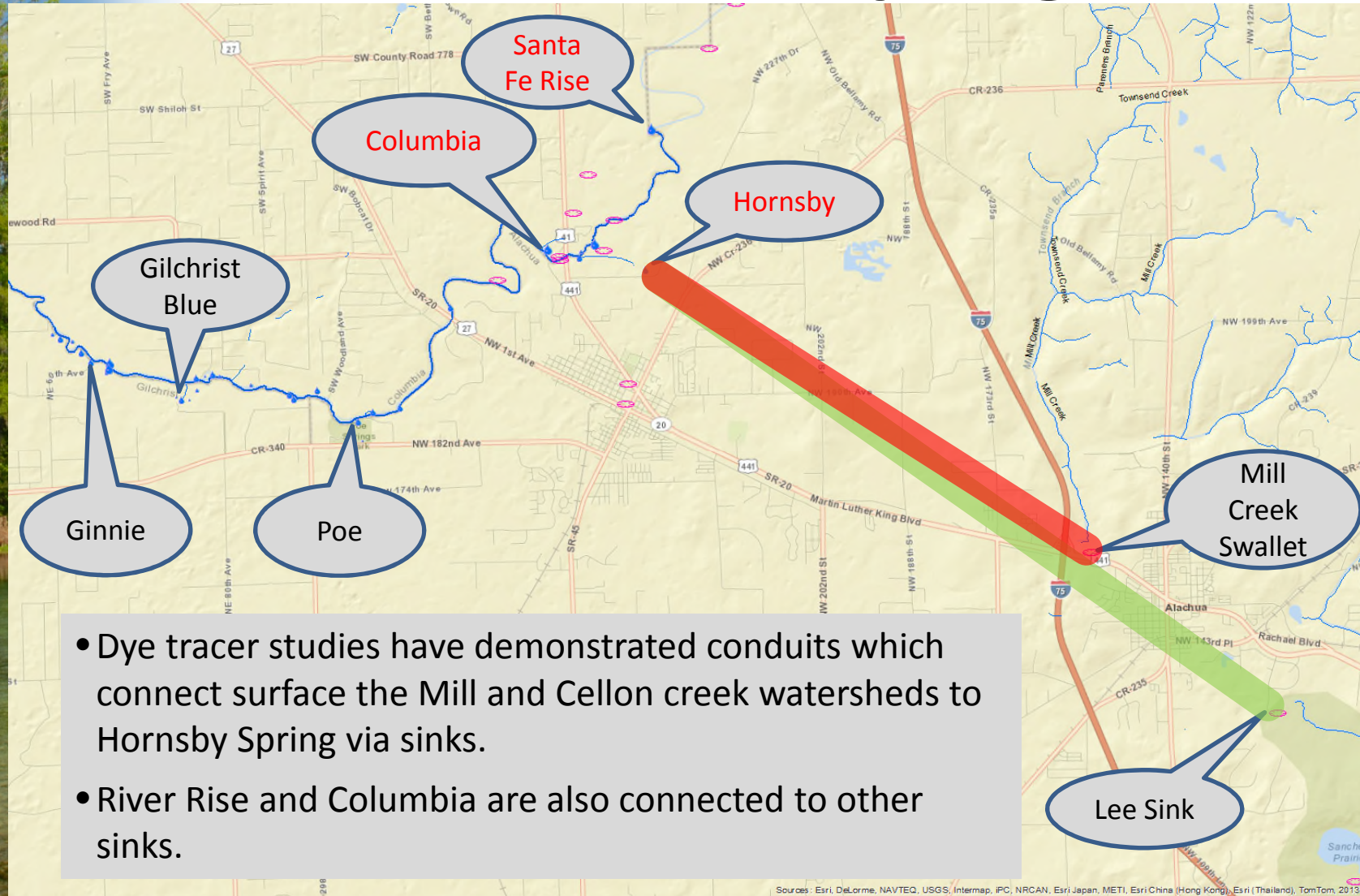
Santa Fe River Swallet and Rise



Santa Fe River Swallet and Rise

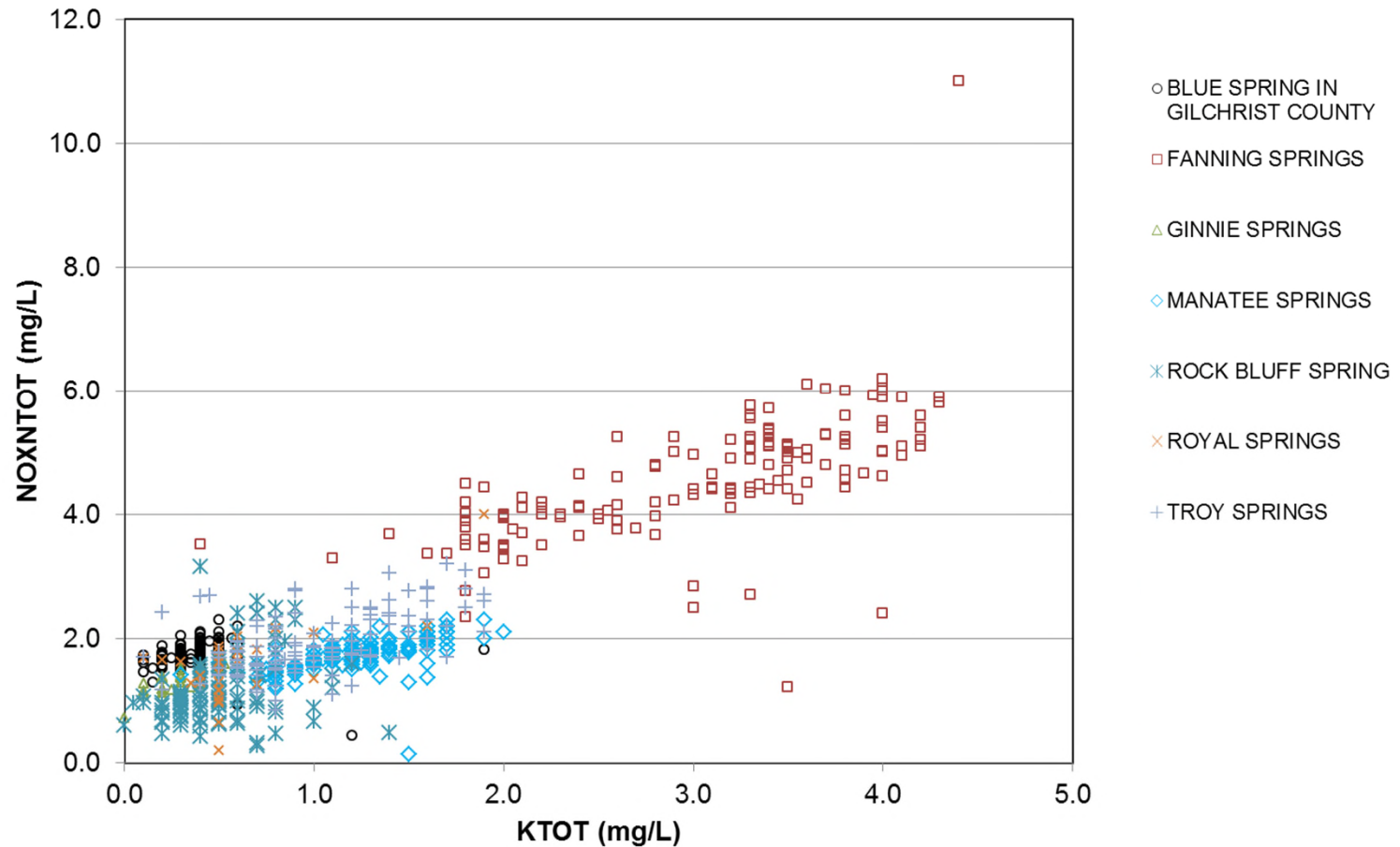


Lower Santa Fe Springs



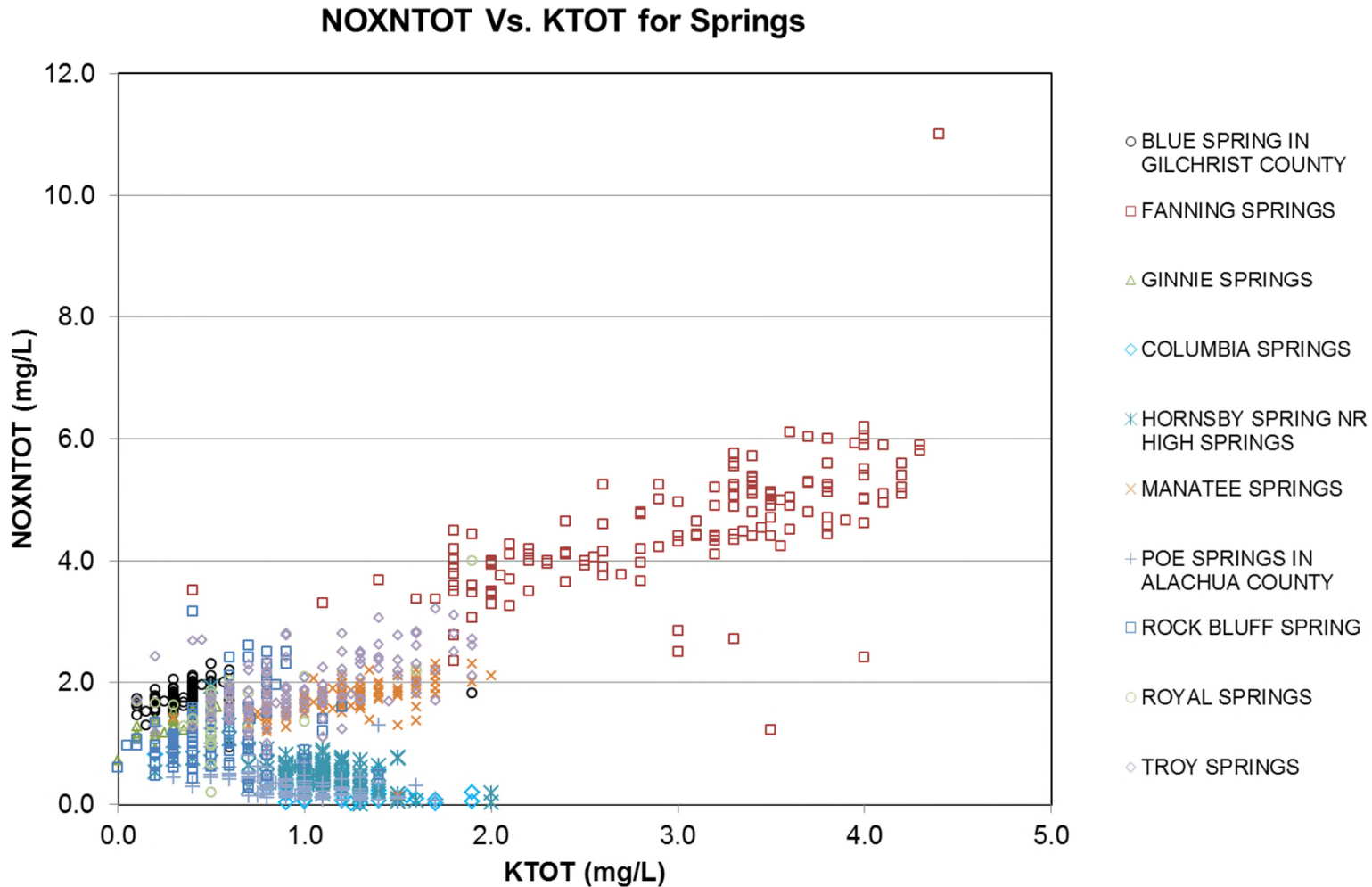


Nitrate Vs. K – Multiple Springs





Nitrate Vs. K





Nitrate and Potassium (K)

| | | Nitrate Trend Over Time | | |
|----------------------------|----------|--|--|----------------------------|
| | | Positive | None | Negative |
| Nitrate Correlation with K | Positive | Ruth / Little Sulfur, Convict, Manatee, Fanning, Ginnie, Rock Bluff | Suwannee Blue, Troy | |
| | None | Gilchrist Blue, Hart | Santa Fe, Telford, Otter, Rum Island, Wacissa, Blue Hole | Little River |
| | Negative | Madison Blue | Columbia | Hornsby, Poe, Treehouse |



Concluding Thoughts

- Need to better understand source(s) of water and nutrients
 - Delineate springsheds (and watersheds)
 - Identify karst features (sinks, caves, conduits)
 - Measure flow reversals
- Need to understand aquifer denitrification rates, limiting conditions
- Look for opportunities to recharge aquifers with clean water... PROJECTS PROJECTS PROJECTS

Questions As You Watch the Santa Fe River Swirl Into the Aquifer?





Thank you!



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